(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 058 532**
A2

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: 82300699.4

(22) Date of filing: 12.02.82

(51) Int. Cl.³: F 02 C 7/00
F 02 K 1/00

(30) Priority: 17.02.81 JP 20146/81 U

(43) Date of publication of application: 25.08.82 Bulletin 82/34

(84) Designated Contracting States: CH DE FR GB LI

(71) Applicant: MITSUBISHI JUKOGYO KABUSHIKI KAISHA
5-1, Marunouchi 2-chome Chiyoda-ku
Tokyo(JP)

(72) Inventor: Aono, Yoshitsugu Nagasaki Shipyard & Engine Works
Mitsubishi Jukogyo K.K. 1-1, Akunoura-machi
Nagasaki-shi Nagasaki-Ken(JP)

(74) Representative: Sommerville, John Henry et al,
Sommerville & Rushton 89, St. Peters Street
St. Albans Herts. AL1 3EN(GB)

(54) **Axial flow turbine nozzle.**

(57) In an axial flow turbine, such as an exhaust gas turbine, in order to prevent the driving gas from escaping through the slits (9) formed in an outer nozzle ring (8) of integral type construction, which divide said ring into several segments so as to facilitate differential thermal expansion, and thus by-passing the regular flow of the gas through the nozzle structure, filler metals (15) are located in the slits.

Preferably, the radial depth of the filler metals is shorter than the slits, and they are fixed e.g. by fixing bolts (17) and tongues (16) provided on the filler metals, so as not to protrude beyond the inner diameter of the outer nozzle ring.

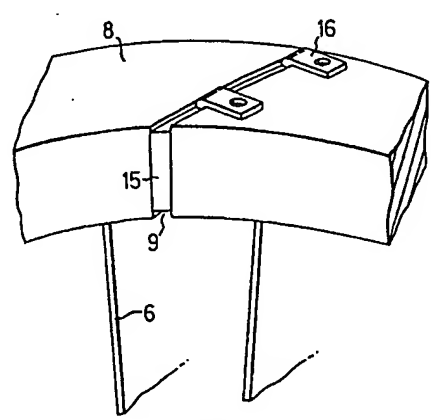

FIG.7

EP 0 058 532 A2

Mitsubishi Jukogyo K.K.
TOKYO, Japan.

Axial Flow Turbine Nozzle.

The present invention relates to axial flow turbines, such as an exhaust gas turbine, and particularly to nozzles for such turbines.

A cross-section of part of an exhaust gas turbine in a conventional known exhaust gas turbine supercharger is shown in Figure 1. In addition, a nozzle of the exhaust gas turbine is shown in Figure 2 in a perspective view, and a part of an outer ring of the nozzle is shown in Figure 3 in plan view.

In these Figures, the turbine is of the axial flow type and exhaust gas from a diesel engine entering a turbine inlet casing 1 passes through the nozzle 2, then drives a turbine rotor 3 by means of the turbine blades 4 and exits through a turbine outlet casing 5.

The nozzle 2 is of the integral type normally used with an axial flow turbine, and it is constructed of nozzle blades 6, an inner nozzle ring 7 and an outer nozzle ring 8 as shown in Figure 2. Generally, stainless steel materials are used for the nozzle blades 6 because of their resistance to heat and corrosion, but the inner nozzle ring 7 and the outer nozzle ring 8 are made of cast iron with the nozzle blades 6 fixed therein.

Within a supercharger in operation, because the temperature of the exhaust gas passing through a nozzle can be as high as 400 to 600°C, the nozzle blades, and the inner and outer nozzle rings will all be subjected to thermal

expansion. In some cases serious damage to the nozzle can be caused by differences in their configuration and material. Accordingly, as a measure for preventing such damage, expansion slits 9 as shown in Figures 2 and 3 are provided at several locations in the outer nozzle ring 8. The slits 9 are formed in a rectilinear shape between the nozzle blades 6 by machining as shown in Figure 3, and thereby the outer nozzle ring 8 is divided into several segments. The size of these slits is, in the case of the nozzle of a large-sixed supercharger, about 3 mm wide and about 170 mm long.

With reference to Figure 1, the flow of gas at high pressure on the inlet side of the nozzle blades enters through the slits in the outer nozzle ring into a sealingly enclosed chamber 10, and then escapes through the same slits towards the outlet side of the nozzle blades at a low pressure.

The turbine of another exhaust gas turbine supercharger of the prior art is shown in cross-section in Figure 4. The state of the same gas turbine section after extraction of the rotor is shown schematically in Figure 5 and the mode of escape of the exhaust gas through the slits is shown schematically in Figure 6.

In this instance, the turbine inlet casing is formed as a double casing structure consisting of an inner casing 11 and an outer casing 12, and this construction is especially advantageous in that extraction of the rotor is made possible without disconnecting the coupling between the exhaust pipe of the diesel engine and the turbine inlet casing of the super-

charger as shown in Figure 5. A gap is provided in the exhaust duct between the said inner and outer casings to allow for the removal of the inner casing 11.

In a turbine inlet casing having such a construction, a part of the high pressure exhaust gas flows through the gap in the boundary section 13 into a sealingly enclosed chamber 14, so that the pressure inside the chamber rises, and the exhaust gas escapes through slits in the outlet side of the nozzle blades as shown by arrow Z in Figure 4.

As shown in Figure 6, escape of fluid through the slits interferes with the regular flow, and results in degradation of the overall performance of the nozzle.

It is therefore one object of the present invention to provide a nozzle in an axial flow exhaust gas turbine which eliminates the above-mentioned disadvantage of the prior art.

According to the present invention, an integral type nozzle for use in an axial flow turbine, in which nozzle a number of slits are formed in the outer nozzle ring so as to divide it into a number of segments in its circumferential direction, is characterised in that filler metals are located in the said slits so as,in use of the turbine, to prevent gas from escaping through said slits.

In the above-featured nozzle, escape of exhaust gas through the slits can be prevented without carrying out any special machining of the nozzle and moreover without being influenced by thermal expansion.

The above-mentioned and other objects, features and advantages of the present invention will become more apparent by reference to the following description of a preferred embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a cross-section view showing the exhaust gas turbine part of an exhaust gas turbine supercharger of the prior art,

Figure 2 is a perspective view of the nozzle in the exhaust gas turbine shown in Figure 1,

Figure 3 is a plan view of part of the outer nozzle ring shown in Figure 2,

Figure 4 is a cross-section view showing the exhaust gas turbine part of another exhaust gas turbine supercharger of the prior art,

Figure 5 is a schematic view showing the state of the exhaust gas turbine in Figure 4 after extracting the rotor,

Figure 6 is a schematic view showing the mode of escape of the exhaust gas through the slits shown in Figure 4,

Figure 7 is a perspective view showing an essential part of a nozzle according to the preferred embodiment of the present invention, and,

Figure 8 is a side view of the nozzle shown in Figure 7.

Referring now to Figures 7 and 8, the preferred embodiment of a nozzle construction in an exhaust gas turbine according to the present invention is illustrated. Thus, for the purpose of preventing damage to the nozzle due to

thermal expansion, slits 9 are formed in the outer nozzle ring 8 similarly to the prior art construction shown in Figure 2, and the width of the slits is a minimum of 2-3 mm, like the nozzles in the prior art, due to machining limitations.

With reference to Figure 7, the outer circumferential edges of the nozzle blades 6 are made integral with the outer nozzle ring 8 during casting, and filler metals 15 made of heat resisting material are inserted into the several slits 9. The thickness of the filler metal 15 is made slightly thinner than the nominal width of the slits 9 so as to leave a small clearance between the opposed surfaces of the slits 9 and their filler metals 15 when fixed; thereby some adaptability for dimensional variations of the width of the slits is retained.

In addition, the radial depth of the filler metal 15 is somewhat shorter than the depth of the slits 9 so as not to protrude beyond the inner diameter of the outer nozzle ring 8, as shown by the dashed line in Figure 8, while for preventing the said metals 15 from being displaced, tongues 16 are provided on each filler metal and are bent down onto the outer circumference of the outer nozzle ring 8 and secured thereto by means of bolts 17.

The effects and advantages obtained with the above-mentioned novel construction will be described below.

By inserting the filler metals 15 into the slits 9, the escape of exhaust gas into and out of the chamber 10 of Figure 1, or into and out of the chamber 14 of Figure 4,

through the said slits 9 can be prevented.

In the case of employing a nozzle construction according to the present invention as described above, the escape of exhaust gas through the slits can be prevented. Accordingly, degradation of the performance of the nozzle can be prevented.

It is to be noted that the clearance between the slit surfaces and the filler metal is so small that no significant escape of gas therethrough can occur.

CLAIMS.

1. A nozzle of integral type for use in an axial flow turbine, such as an exhaust gas turbine, in which nozzle a number of slits are formed in its outer nozzle ring so as to divide it into a number of segments in its circumferential direction, characterised in that filler metals (15) are located in the said slits (9) so as, in use of the turbine, to prevent gas escaping through said slits.

2. An integral turbine nozzle as claimed in Claim 1, characterised in that the radial depth of the filler metals is somewhat shorter than the depth of the slits, and in that said filler metals are fixed by fixing means (16, 17) so as not to protrude beyond the inner diameter of said outer nozzle ring (8).

3. An integral turbine nozzle as claimed in Claim 1, or 2, characterised in that the slits are machined to be of a norminal width, and in that said filler metals are made slightly thinner than the nominal dimension, any clearance left when located being sufficiently small that no significant escape of gas can occur therethrough.

4. An integral turbine nozzle as claimed in any one of Claims 1 to 3, characterised in that, the filler metals are provided with tongues (16) which can be bent over and are fixedly secured, (e.g. by bolts 17) to the outer circumference of the outer nozzle ring.

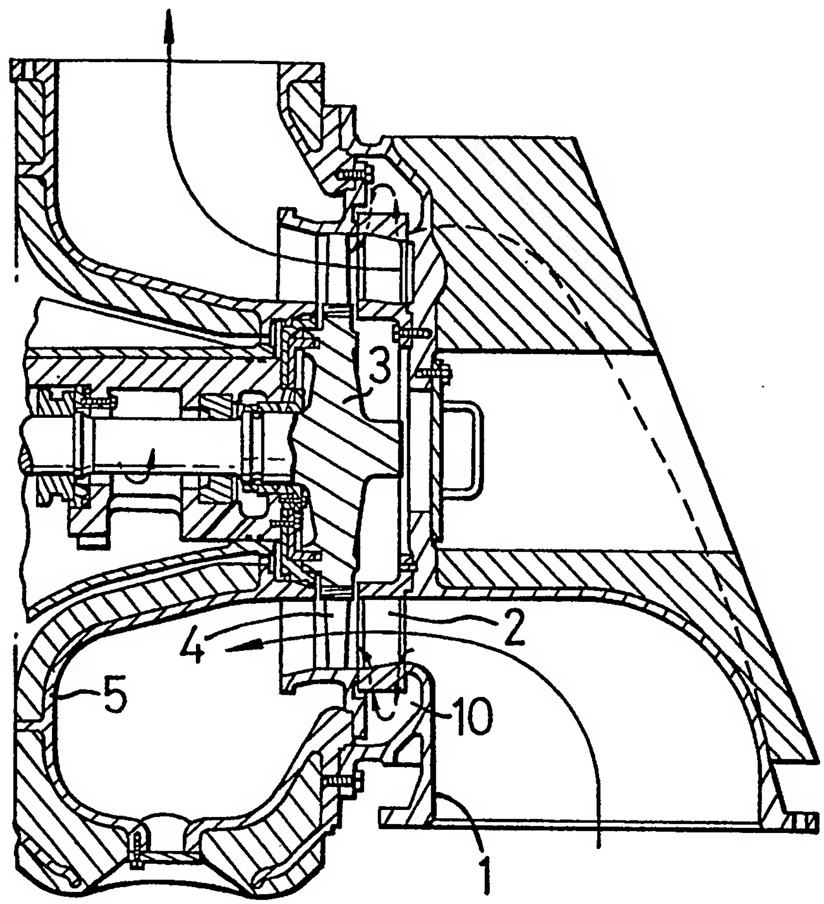

FIG.1

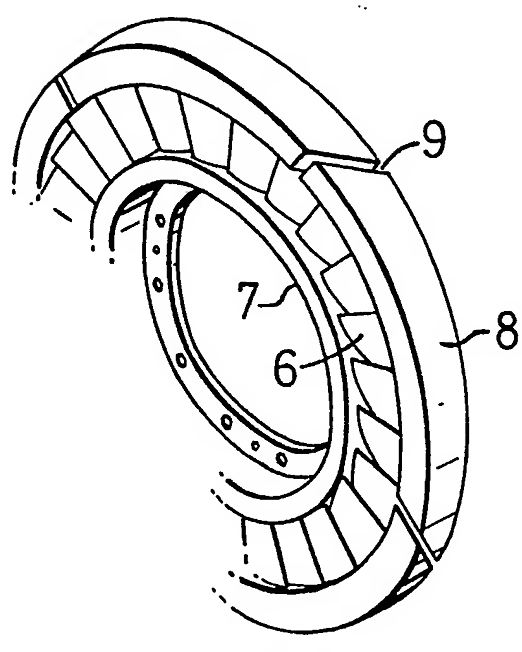

FIG.2

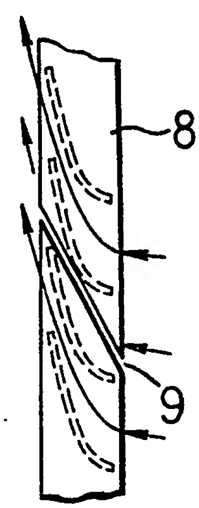

FIG.3

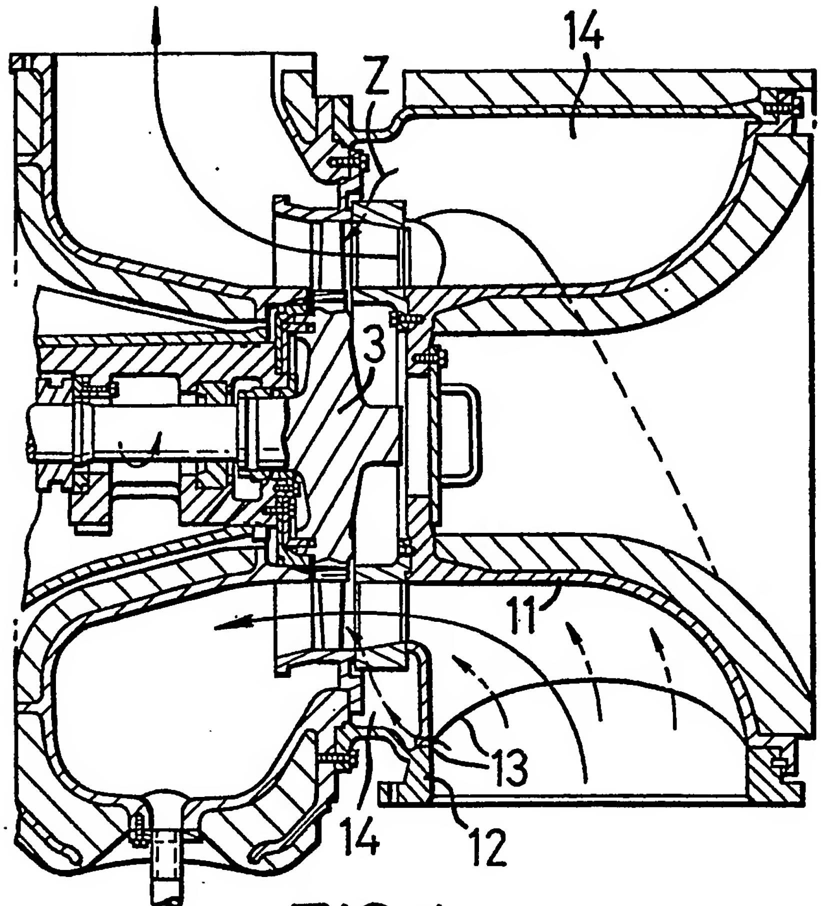

FIG. 4

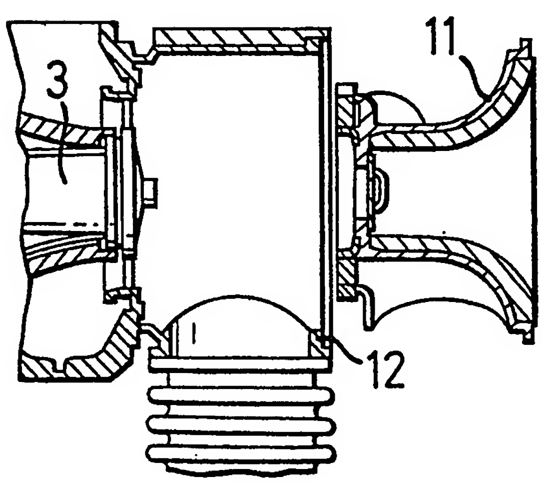

FIG. 5

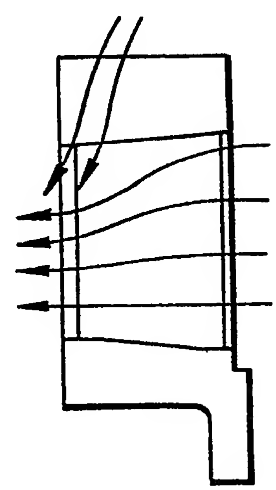

FIG. 6

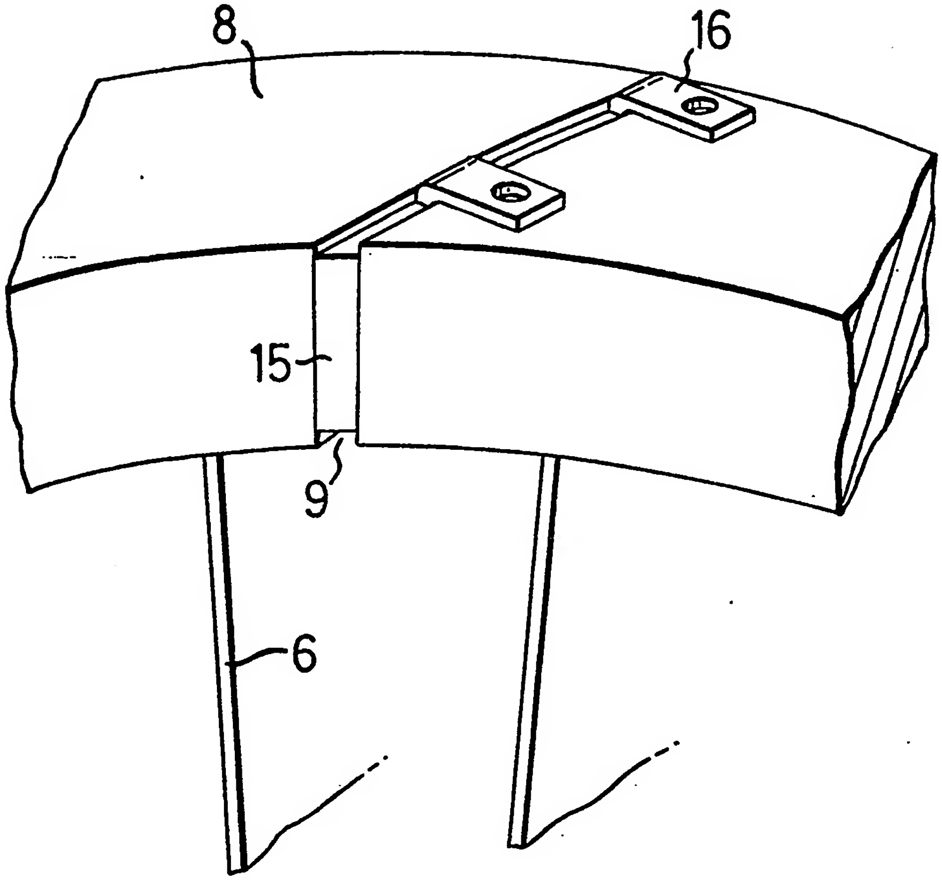

FIG.7

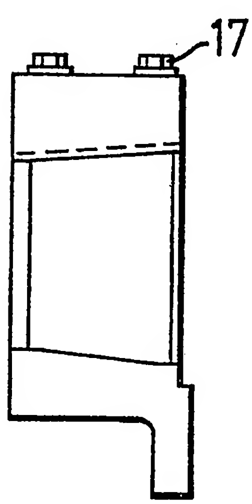

FIG.8